

New data sources for precision agriculture – blessing or curse?

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Up-to-date information on the status of crops is an important prerequisite for crop management and the development of site specific measures. Often miscellaneous data sources are already available on farms, for example tractor-mounted sensors, or yield and soil mapping facilities. A major drawback of this type of technology is that the farmer has to pass over his fields with his machinery to acquire this information. This is only economically beneficial if an application is performed at the same time (e.g. fertilizing, pest control, harvest). However, continuous monitoring of the cropland of farmers would be desirable to identify required urgent management actions at an early stage.

Remote sensing offers new opportunities to receive valuable information on current crop properties. The European Copernicus programme will launch up to ten earth observation satellites for different applications until 2020. The Sentinel-1 (radar) and Sentinel-2 (optical) satellites are already in orbit. They are very interesting for agricultural applications due to their high temporal (5-6 days revisit time) and spatial (10-20 m) resolution. In addition the EU follows an open data policy, so all data are available at no costs. However, the high spatial resolution results in huge datasets. The smallest radar dataset is 1 GB in compressed size, a tile of optical data is about 7GB in size. The resulting data volume sums up to several peta-bytes per day (full expansion stage: radar data every 2 days, optical data every 3-4 days), creating a huge demand on the data access, processing, infrastructure and interpretation. At present, the Sentinel data as provided by the European Space Agency is not applicable for agricultural practice.

So far, optical satellite remote sensing products have been sparsely used in practical farming. High costs of data purchase and data processing on the one hand, and uncertain data availability due to high cloud cover frequencies in Germany on the other hand, limited the use to research and a few financially strong companies.

With the project “AGRO-DE”, a consortium composed of Julius Kühn-Institut (JKI), the German Aerospace Centre (DLR), and the private companies EOMAP (remote sensing) and Hanse Agro (agronomic consultant), will prepare the Copernicus Sentinel-1 and Sentinel-2 satellite data for farmers and their specific needs and applications.

This way, it will be possible to reach farms that have not yet been in the focus of remote sensing applications due to their size and technical resources. In particular, small-scale farms and farms with organic farming will then gain the opportunity to participate in the technological development. Further, they will be able to test resource-efficient, site-specific management practices without a large start-up investment.

In the past years, another remote sensing technology, unmanned aerial vehicles (UAV) also known as drones, has taken an exciting technological development. The technology is driven by robotics and the complex technology has been made so simple to use, that everybody can run an autonomous drone after some hours of training. An UAV is simply just a platform to carry imaging sensors. The simplest way is a digital photo camera which can produce geo-coded image mosaics and digital elevation models at the same time. By now, software is available that enables everybody to perform complex photogrammetric analysis just with a few clicks and a powerful computer, and without having a deeper technical background. One big drawback for UAV operation is the limited battery power, resulting in short flight times and low ground coverage. Thus, UAVs are more suitable for small businesses with little acreage or large enterprises that require fast information on specific but restricted areas. For a routine monitoring, UAVs are not yet appropriate. A second weak point by now is the limited use of multi- and hyperspectral cameras in practical applications due to their tremendous costs. However, hyperspectral imaging has proven several advantages over multispectral imaging.

The times to retrieve up to data of agricultural fields have changed very positively. Huge data sources are available at low costs, but assistance is needed to prepare the available raw data to meaningful information for farmers. We do not have a lack of data; we have a lack of value-added information!